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AUTHOR Fleming, India; Baum, Andrew
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ABSTRACT

Historically, most investigations of the social and psychological effects of disaster have focused on describing the impact of single traumatic events rather than on developing an understanding of how disasters or particular characteristics of disasters affect various groups of victims. This study investigated the hypothesis that stress caused by a technological disaster would be higher months after the incident than stress following a natural disaster. Levels of stress and feelings of helplessness were compared for three subject groups: (1) 27 residents of a community immediately adjacent to a leaking toxic waste dump; (2) 23 residents of a community which had been flooded; and (3) a demographically similar comparison group (n=27). Stress was measured using the Symptom Checklist: 90R (a self-report measure of emotional and physiologic distress), a proofreading task as a performance measure, and analyses of urinary catecholamines measuring physiological arousal. Questionnaires of life events, demographics, and background characteristics were used to control for other sources of stress. The results revealed that residents of the landfill neighborhood exhibited higher levels of stress across self-report, behavioral, and biochemical domains of measurement than did residents of either the flood neighborhood or the comparison neighborhood. These landfill residents also reported feelings of helplessness more frequently than did flood victims or the comparison group. Although this disaster study was essentially a case study, the hypothesis that technological disasters are more likely to cause chronic stress than are natural disasters was supported. (ABL)

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Characteristics of Disaster Associated with Chronic Stress

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India Fleming & Andrew Baum

Uniformed Services University of the Health Sciences

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Historically, most investigation of the social and psychological effects of disaster has focused on describing the impact of single traumatic events, such hurricanes, floods, or fires, rather than on developing an understanding of how disasters or particular characteristics of disaster affect various groups of victims. In recent years several investigators in the field (McLuckie, 1975; Quarentelli, 1978) have proposed models describing disaster characteristics and disaster effects. Many of these models suggest plausable dimensions on which disasters may differ. These differences may be associated with their psychological effects. However, because most studies of disaster have investigated the impact of a single event, and because methods and measures vary greatly from one study to another, meaningful comparison of the effects of specific disaster characteristics has been difficult. One distinction which has been made by several disaster theorists is that between natural and human-caused or technological disaster (e.g. Baum, Fleming, & Davidson, 1983; Glaser, Green, & Winget, 1981). Examination of studies of isolated events of these two types suggests that natural and technological disasters may differ in the duration of their psychological consequences (Baum et al., 1983). Specifically, it has been hypothesized that the stress caused by a technological disaster would be higher many months after the incident than would stress following a natural disaster. The purpose of this study was to investigate this hypothesis by examining the prevalance of stress in two groups of disaster victims --people living adjacent to a leaking toxic waste site and people living in a recently flooded area -- and in a comparison sample.

There are several reasons to suspect that many technological disasters may cause more persistant or chronic stress than would most natural disasters. These include their effects on perceptions of control and attributions of blame which are likely to differ between victims of natural and technological disasters. Perceptions of control and attributions of blame and responsibility have been found to be associated with stress and with the speed of recovery folllowing victimization (Glass & Singer, 1972; Cohen, 1980; Bulman & Wortman, 1977). Technological disasters may have a greater impact on people's perceptions of control. None of us expect that we can control natural disasters, therefore, although the occurrance of a natural disaster may highlight an existing lack of control it is unlikely to change a person's perception of control. On the other hand, we, as a society, expect that we control our technologies; when breakdowns and failures occur they may signal a loss of control. Likewise, the existence of people or agencies that may be perceived as responsible in technological disasters may encourage affected populations to blame

these entities for their victimization. Research on other types of victimization suggests that this external assignment of blame may be associated with slower psychological recovery.

In addition, technological disasters are more likely than are natural disasters to involve hazardous substances such as radiation or toxic chemicals. The perception, whether or not it is veridical, that one has been exposed to hazardous substances may be a very potent source of chronic stress. Unlike most other forms of disaster, events involving hazardous substances lack a clear 'low point' -- a time when the worst is over and things will get better. In disasters such as storms and earthquakes the damage generally occurs quickly, and in a matter of hours or days the worst is over and people can turn their attention to recovery. However, the threats to human health and well-being created by exposure to radiation and toxic chemicals may not show up for several years. Thus these events are unique in that they cause ongoing uncertainty about the nature and the degree of the threat. The continuing uncertainty may be worse for many people than was the original event.

Finally, in instances involving hazardous substances, the environmental hazards may persist much longer than in most natural disasters. As a society we do not yet have widely accepted ways of safely disposing of radioactive and toxic substances. Therefore clean-up efforts following disasters involving these substances may take years as proposals are evaluated, modified, and implemented. During this time people living nearby may be at risk for further exposure to hazardous substances. Even if there is no real danger of exposure people are likely to perceive the presence of these substances as a threat, and this too can contribute to stress.

In order to examine chronic stress following both a natural and a technological disaster the present study compared levels of stress and feelings of helplessness in three groups; residents of a community immediately adjacent to a leaking toxic waste dump, resident of a community which had been flooded, and a demographically similar comparison group. The landfill community was located in a Mid-Atlantic state. Although some residents of the community had wondered whether the landfill might contain chemicals virtually all of them became aware of the danger in December, 1982, when the Environmental Protection Agency reported the presence of several hazardous chemnicals in the soil groundwater. At that time the landfill was listed amont the 10 potentially most hazardous waste sites in the country. Also in December, 1982, a series of storms dumping snow and heavy rain over several Southern States caused rivers throughout the region to overflow

their banks flooding several communities. Residents of the community sampled in this study experienced flooding in their homes resulting in damage to possessions, but their homes remained intact. The study was conducted 9 months after the occurrance of the flood and the announcement of chemical hazards in the waste site.

It was predicted that residents of the landfill neighborhood would exhibit more symptoms of stress than would residents of the flood or the comparison neighborhoods. The flood and the comparison groups were not expected to differ from each other. It was also expected that landfill area residents would report more feelings of helplessness than would residents of the other two areas.

Method

Subjects

A total of 77 subjects participated in this study. They were selected using a quasi-random sampling procedure from three demographically comparable neighborhoods. The toxic sample (n = 27) was selected from streets bordering a leaking toxic waste dump, the flood group (n = 23) from streets within a recently flooded community, and the comparison group (n = 27) from randomly sampled streets within a control neighborhood.

Procedure

Subjects were approached in their homes and asked to participate in a study of response to environmental threats and hazards. A multilevel approach to stress measurement was used. The Symptom Checklist -90R (SCL-90R; Derogatis, 1977), a self-report measure which reflects affective and somatic aspects of stress was used to measure emotional and physiological distress. A proofreading task devised by Glass and Singer (1972) was used as a performance measure of stress. Finally, physiological arousal was measured using assays of urinary catecholamines: epinephrine and norepinephrine. Feelings of helplessness and perceptions of control were assessed by asking subjects to indicate the degree to which they had been bothered by feeling helpless and by feeling that choices they made did not matter. To control for the impact of other sources of stress subjects completed a life events questionnaire and provided information on demographic and background characteristics.

Results

Between group comparisons revealed no differences between the three groups on

demographic characteristics or experience of other sources of stress.

The major hypothesis, that residents of the toxic neighborhood would evidence elevated levels of stress relative to residents of the flood and the comparison neighborhoods was initially tested using a multivariate analysis. This test revealed a significant between group difference, Wilkes lambda = .58, appriximate F 14,122) = 2.69, $p < .01$. Univariate analyses of variance with mean contrasts revealed significant between group differences on each of the major stress measures. On the SCL-90R, subjects in the toxic group reported experiencing more total symptoms and more symptoms of somatization, interpersonal sensitivity, depression, anxiety, phobic anxiety, paranoid ideation, and psychotocism than did subjects in the flood and the comparison groups. The pattern of performance on the proofreading task also indicated greater stress among residents of the toxic neighborhood than in residents of the flood and the comparison neighborhoods. The biochemical data also suggest greater stress among people residing near the toxic wase site. Residents of the toxic area had higher levels of both epinephrine and norepinephrine than did residents of the flooded area; the comparison group did not differ significantly from either of the other two groups.

Finally, chi-square analyses comparing the frequency of reported distress due to feelings of helplessness between the three groups revealed significant differences. More subjects in the toxic group reported being bothered by feelings of helplessness and by not caring whether they did one thing or another than did subjects in the flood and the comparison groups.

Discussion

As a step toward examining the hypothesis that technological disasters may be more likely to cause chronic stress than natural disasters, levels of stress were examined in three groups of subjects; victims of a technological disaster involving a leaking toxic waste dump, victims of a naturally occurring flood, and a comparison group. As expected, residents of the landfill neighborhood exhibited higher levels of stress across self-report, behavioral, and biochemical domains of measurement than did residents of either the flood neighborhood or the comparison neighborhood. Specifically, people residing near the landfill reported more symptoms reflecting somatic and emotional distress, performed less well on a task requiring concentration and motivation, and exhibited higher levels of both epinephrine and norepinephrine in their urine. The flood and the comparison group did not differ on any of the stress measures. The study also examined feelings of helplessness in response to victimization by disasters. As expected, residents

of the landfill neighborhood reported being bothered by feelings of helplessness more frequently than did residents of the flood and the comparison neighborhoods. The similarity of the flood and the comparison groups suggests that the experience of the flood did not cause elevations in stress persisting as long as nine months post-disaster.

Because victims of the two different types of disaster were studied simultaneously using identical measures, these data allow clearer comparison of the effects of different types of disaster than has been previously possible. The results of this study support the hypothesis that technological disasters may be more likely to cause chronic stress than natural disasters. This finding must be interpreted with caution, because, at the level of disaster this was essentially a case study examining only one disaster of each type. Understanding exactly which aspects of the two disasters account for the differences between the victim groups is complicated; the experience of the landfill and the flood group differed in several ways. Differences in the natural/technological nature of the events, in the involvement of hazardous substances, and in the duration of he environmental threat may all contribute to the elevated levels of stress found among residents of the landfill group relative to the other groups. Additionally, one could argue that the flooding that we studied was mild in comparison to some natural disasters; no one died, and homes were damaged but not destroyed. Future research comparint these types of disasters should consider the magnitude as well as the type of disaster event.

Our interpretation of the results is further supported by other studies of similar disasters. The similarity of these results to findings from studies of the accident at TMI (e.g. Baum, Gatchel, & Schaeffer, 1983) and from studies of victims of other natural disasters (e.g Milne, 1977; parker, 1977, Penick, Powell, & Sick, 1976) suggests that some aspect of technological disasters, at least those involving potential exposure to hazardous substances, contributes to stress lasting months and perhaps years following the onset of the event. Further studies comparing stress levels between victims of a variety of both technological and natural disasters would enable researchers to better understand which characteristics of the experience of disaster are associated with chronic effects.

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